National Aeronautics and Space Administration

Commercial Spaceflight Status Briefing

September 2012

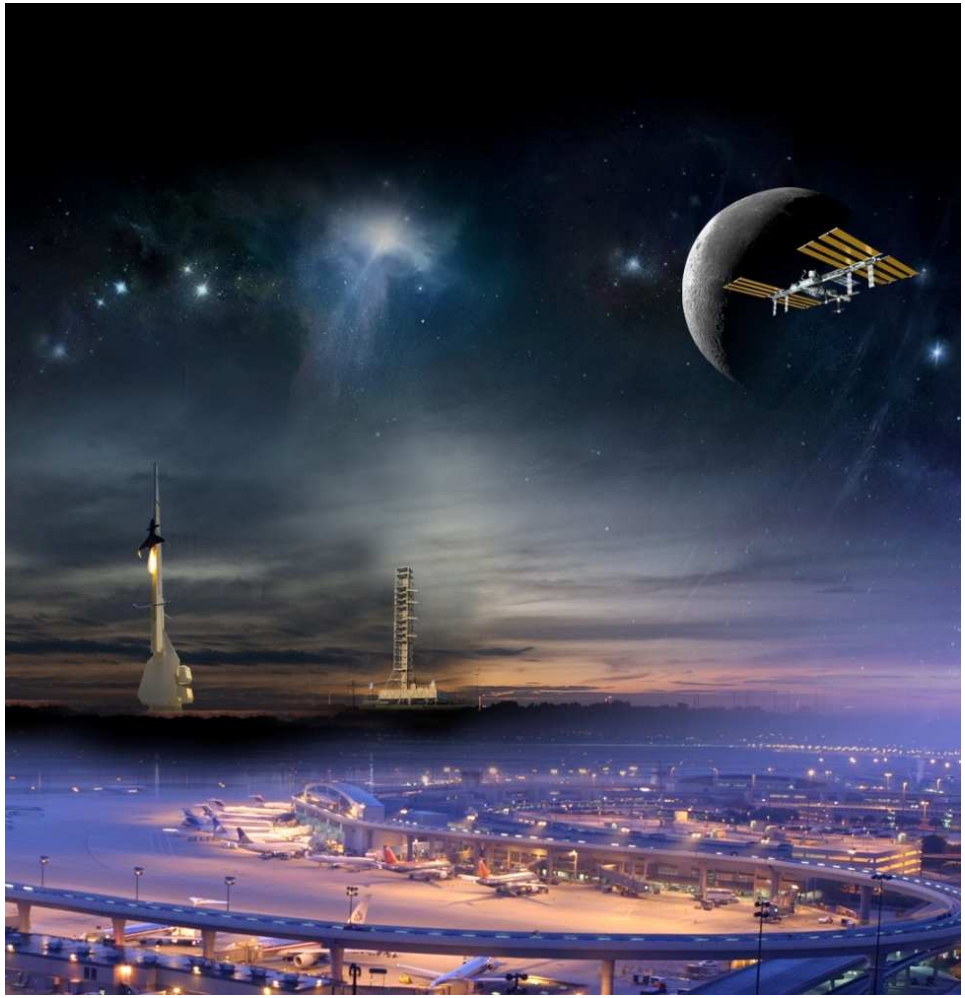
Agenda

- Commercial Spaceflight Vision and Approach
- Commercial Cargo Status
- Commercial Crew Development Round 2 Status
- Commercial Crew Integrated Capability (CCiCAP)

The Future State

- The vision of commercial human spaceflight to Low Earth Orbit (LEO) is a robust, vibrant, profit-making commercial enterprise with many providers and a wide range of private and public users.

- NASA's commercial spaceflight initiatives are helping to make this vision a reality.



“Commercial” at NASA

Program Characteristic	Early Space Age Approach	Commercial-Oriented Approach
Owner	NASA	Industry
Contract Fee-Type	Cost Plus	Fixed Price
Contract Management	Prime Contractor	Public-Private Partnership
Customer(s)	NASA	Government and Non-Government
Funding for Capability Demonstration	NASA procures capability	NASA provides investment via milestone payments
NASA’s Role in Capability Development	NASA defines “what” and “how”	NASA only defines “what” (Industry defines “how”)
Requirements Definition	NASA defines detailed requirements	NASA defines top-level capabilities needed
Cost Structure	NASA incurs total cost	NASA and Industry cost share

Commercial Crew Approach

Traditional NASA Development

Goal: ISS Crew Mission

Extensive Government Involvement

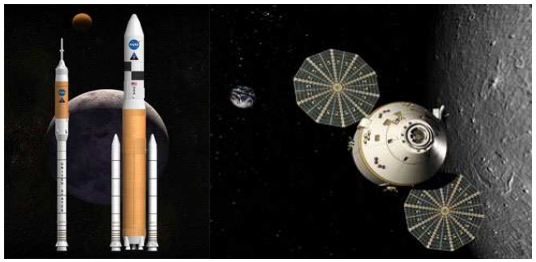
No Cost Sharing

Government Owns IP

Detailed Design Requirements

Unlimited Data and Lots of Deliverables

Higher Costs



Non-Traditional Development

Goal: Commercial Human Transport

Limited Government Involvement

Cost Sharing

Commercial Partner Owns IP

Tailored Human-Rating Requirements

Pay-for-Performance Milestones

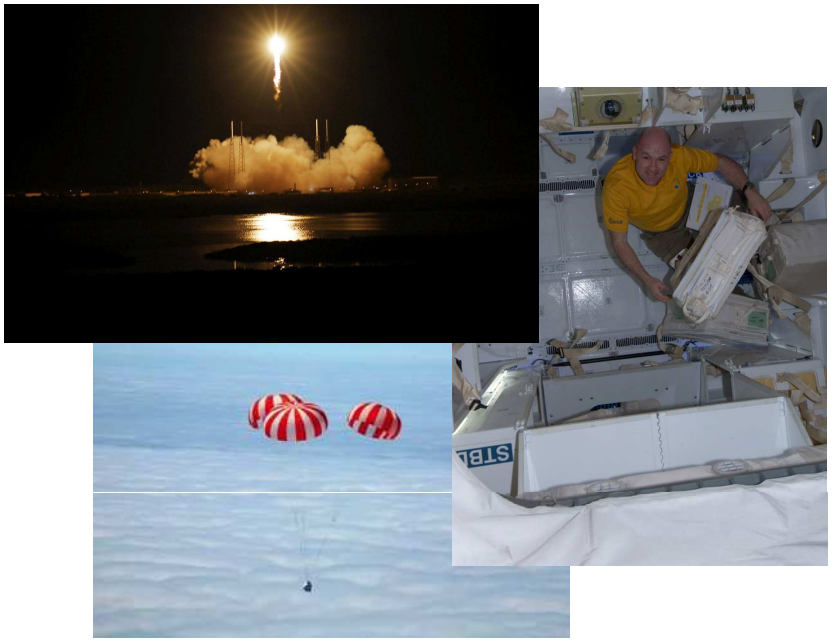
Lower Costs

NASA had clearly chosen a non-traditional development approach for the Commercial Crew Program.

Commercial Cargo Status

- SpaceX
  - After 72 months, 40 milestones, and a $396M investment from NASA, SpaceX developed and brought into operations:
    - A new U.S. intermediate class commercial launch vehicle (Falcon 9),
    - A spacecraft (Dragon), and
    - A launch pad (LC-40)

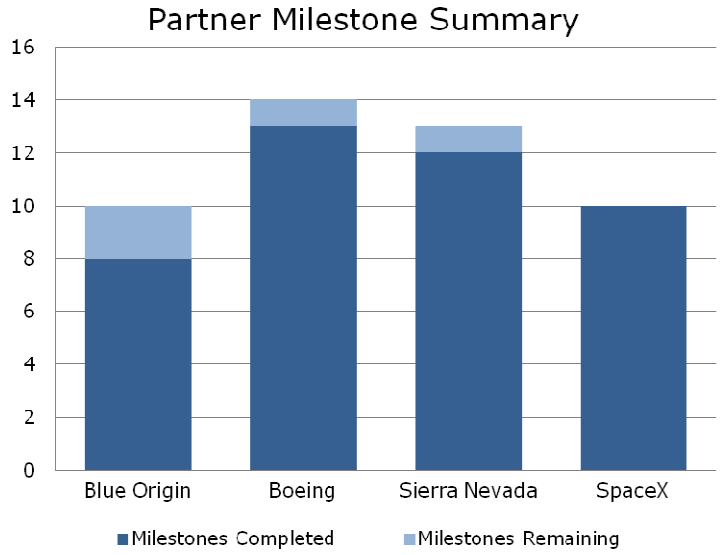
    capable of safely transporting cargo to the ISS and returning cargo to the Earth.



- Orbital Sciences Corporation
  - Orbital Sciences has completed 24 of 29 milestones and received $266.5M out of $288.
  - The maiden test flight date of the Antares is under review but could occur in October 2012. The Demonstration Mission will potentially occur 3 months after the maiden flight.

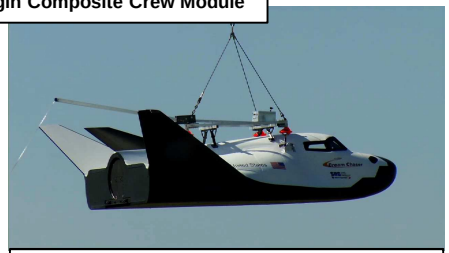
Commercial Crew Development (CCDev2)

- Objective: Mature the design and development of elements of U.S. crew transportation systems, such as launch vehicles and spacecraft.
- Four companies selected in April 2011:
  - Blue Origin awarded $22M
  - Boeing awarded $113M
  - Sierra Nevada Corporation awarded $106M
  - SpaceX awarded $75M




Boeing Parachute Test


Blue Origin Composite Crew Module


Sierra Nevada Dream Chaser Test

SpaceX Crew Cabin Test

Commercial Crew Integrated Capability (CCiCAP)

- CCiCap Goals:
  - Advance multiple integrated crew transportation systems
  - Commercial Provider investment
  - Affordable development costs leading to cost-effective access to LEO
  - Develop a CTS capability to LEO that supports a commercial market

- Base Period: 21 months, August 2012 – May 2014, culminating in a level of maturing approximately equivalent to a Critical Design Review (CDR).

- Optional Milestones Period: Following the Base Period through orbital crewed flight demonstration.

- Awards made to three companies in August 2012:
  - Sierra Nevada Corporation
  - SpaceX
  - Boeing

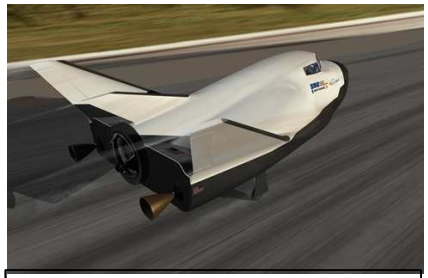
Sierra Nevada Corporation

- **Descriptions & Features**
  - Dream Chaser spacecraft is a reusable, piloted, lifting body, derived from NASA HL-20 concept
    - Carries up to 7 crew members
    - Utilizes non-toxic propellants
    - Primary Launch Site: Cape Canaveral, Florida
    - Primary Landing Site: Shuttle Landing Facility, Florida
    - Abort scenario leverages primary propulsion system with an ability to abort to a runway landing
  - Atlas V vehicle launched from the Space Launch Complex 41 launch pad

- **Base Period**
  - $212.5M total NASA funding for 9 milestones
  - Significant progress toward completion of critical design
  - Two major safety reviews and significant subsystem technology maturation and hardware testing

Artist rendition of Dream Chaser in low-Earth orbit

Artist rendition of Dream Chaser and Atlas V on launch pad

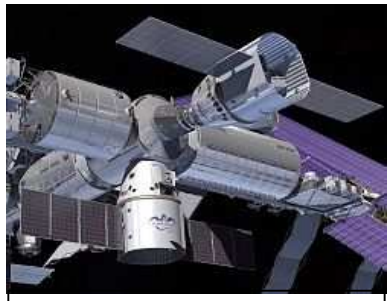


Artist rendition of Dream Chaser landing on a runway

SpaceX

- **Descriptions & Features**
  - Spacecraft uses a crewed version of the SpaceX Dragon capsule
    - Carries up to 7 Crew
    - Primary Launch Site: Cape Canaveral, Florida
    - Primary Landing Site: “On land” landing, specific landing site in work
    - Integrated, side-mounted launch abort system utilizing SuperDraco engines
  - Upgraded Falcon 9 vehicle launched from the Space Launch Complex 40 launch pad
  - Mid calendar year 2015 crewed test flight (dependent on funding and technical progress)

- **Base Period**
  - $440M total NASA funding for 14 milestones
  - Culminates in an integrated critical design review
  - Includes a pad abort test and an in-flight abort test



Artist rendition of Dragon attached to ISS

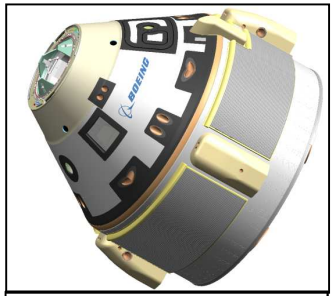
Picture of Falcon 9 rocket on launch pad in Florida

Artist rendition of Dragon re-entering Earth’s atmosphere

Boeing

- **Descriptions & Features**
  - CST-100 spacecraft is a reusable capsule design utilizing many proven flight components
    - Carries up to 7 people
    - Primary Launch Site: Cape Canaveral, Florida
    - Primary Landing Site: “On Land” landing, specific landing site in work
    - “Pusher” launch abort system
  - Atlas V launch vehicle using the dual engine Centaur upper stage configuration and launched from the Space Launch Complex 41 launch pad
  - Late calendar year 2016 crewed test flight (dependent on funding and technical progress)

- **Base period**
  - $460M total NASA funding for 19 milestones
  - Culminates in an integrated critical design review
  - Significant propulsion system, avionics, and wind tunnel development and testing



Artist rendition of the CST-100 spacecraft

Artist rendition of CST-100 and Atlas V on the launch pad

Successful parachute drop test accomplished during CCDev2